

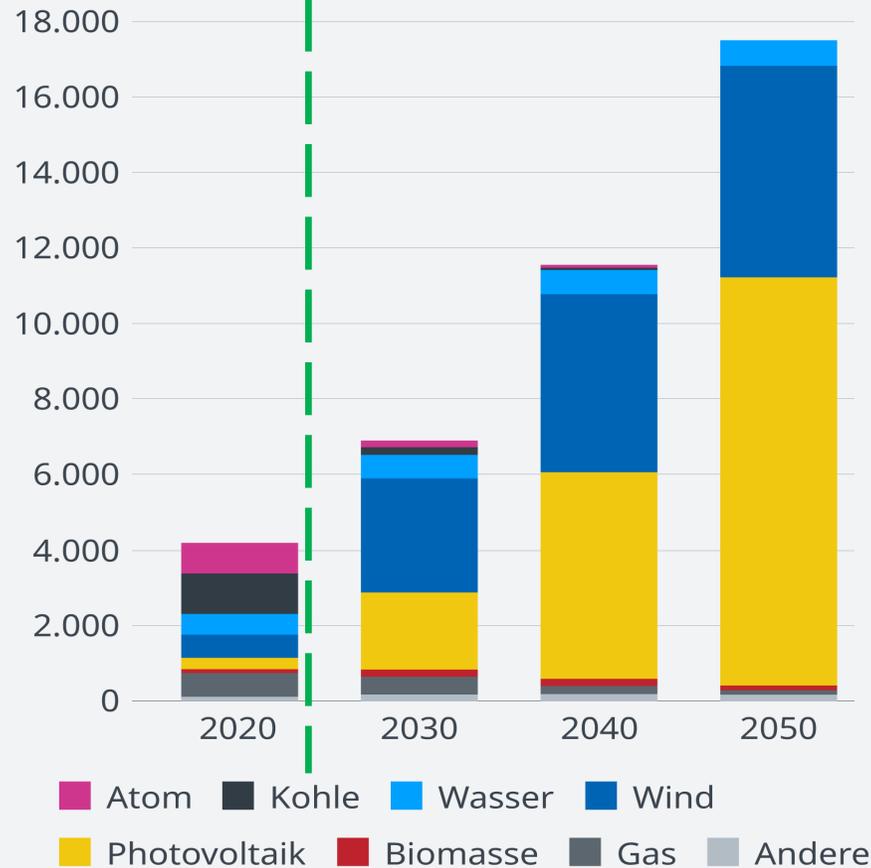


VCE

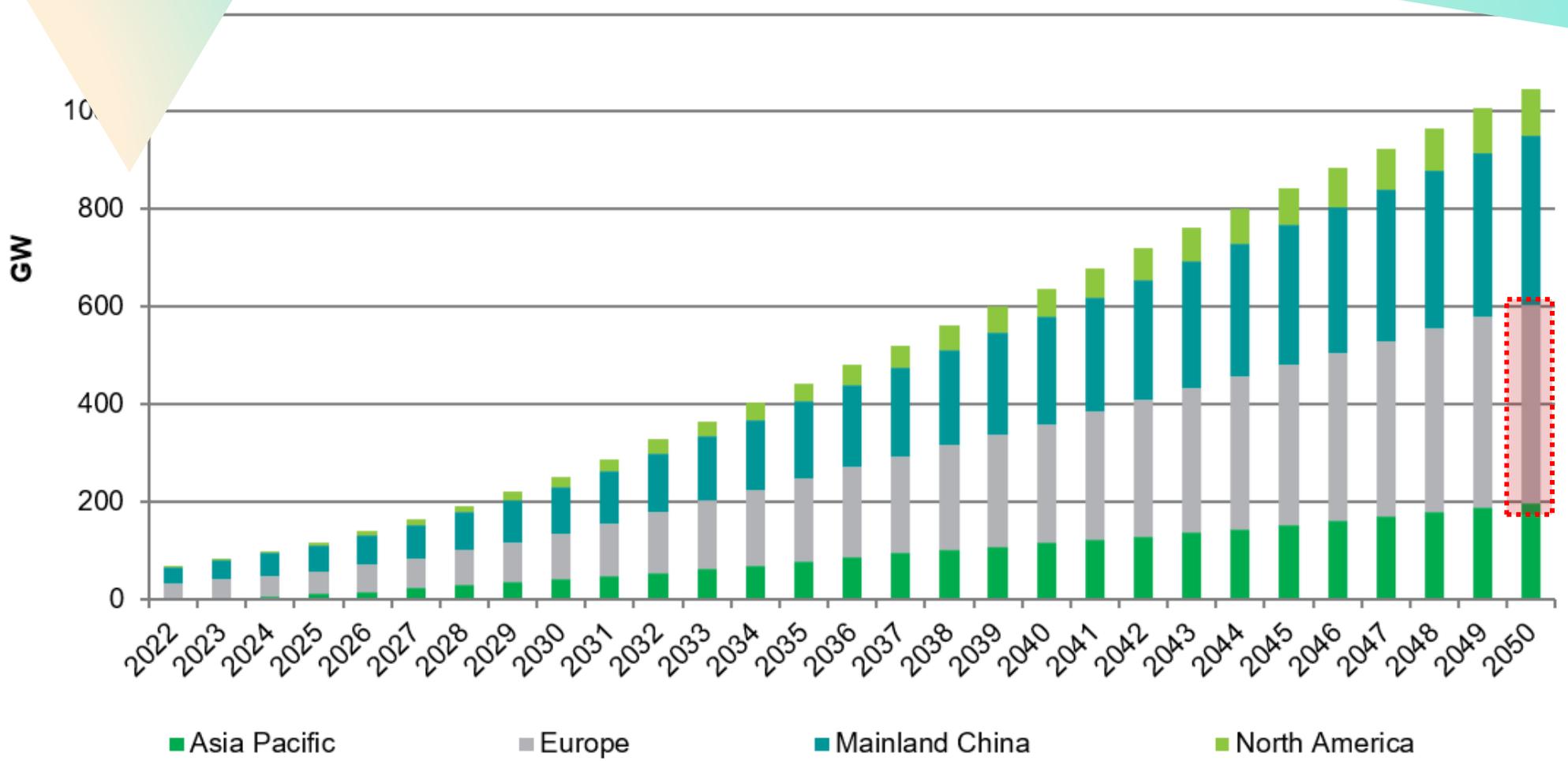
OFFSHORE WINDKRAFT: EUROPAS SAUBERE ENERGIE DER ZUKUNFT

Andreas Schörghofer-Queiroz & Peter Furtner
KliNa-Tag, 10. September 2024

Stromerzeugung in Europa In Terrawattstunden



Global offshore wind installed capacity outlook by 2050, by region



ca. 400 GW

Source: IHS Markit

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Offshore Wind in Europa

Europe's Offshore Wind Farms

Status of Offshore Wind Projects

Online	■
Partially online	■
Under construction	■
With permits	■
Under permitting procedure	■
Planned	■

31 GW

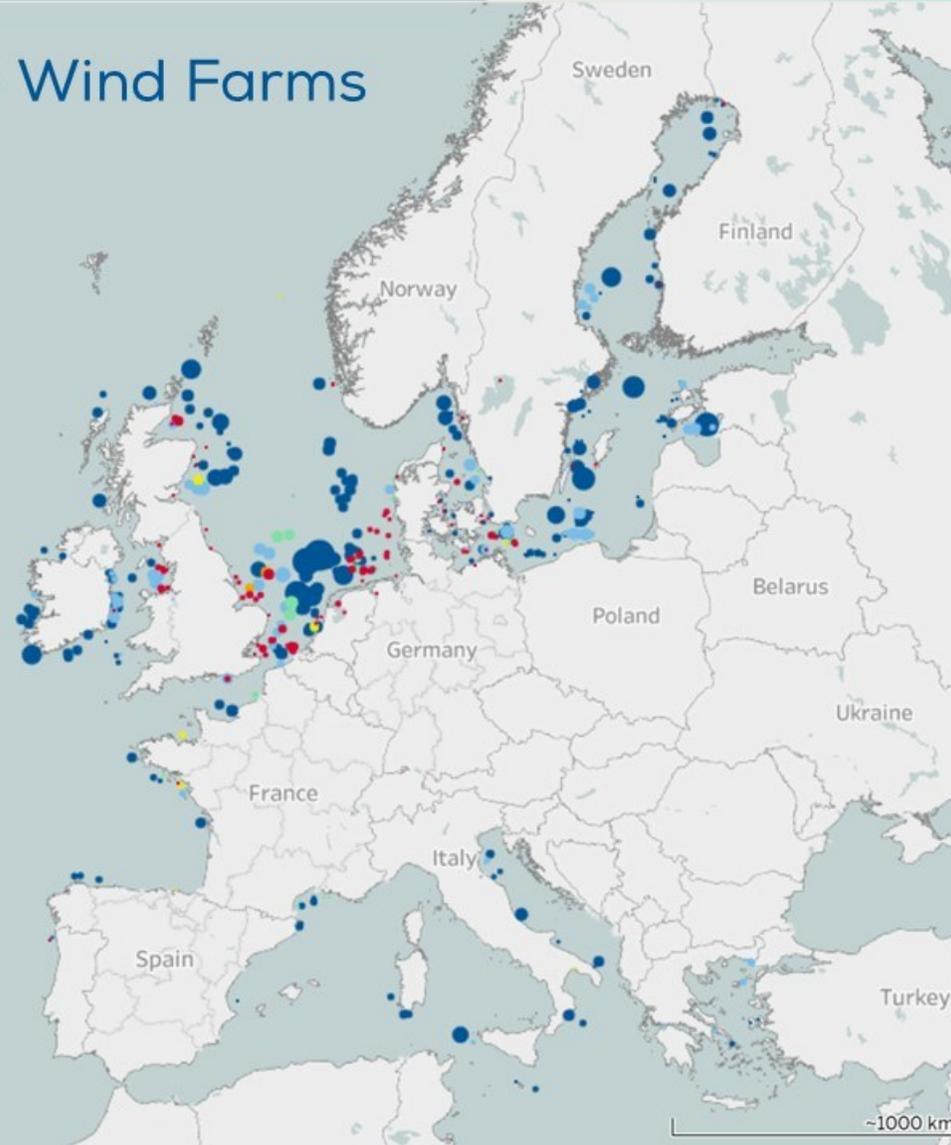
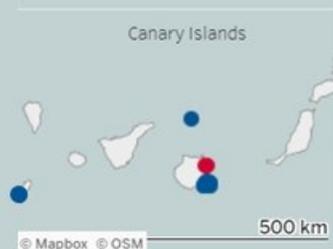
Online

9 GW

Under construction

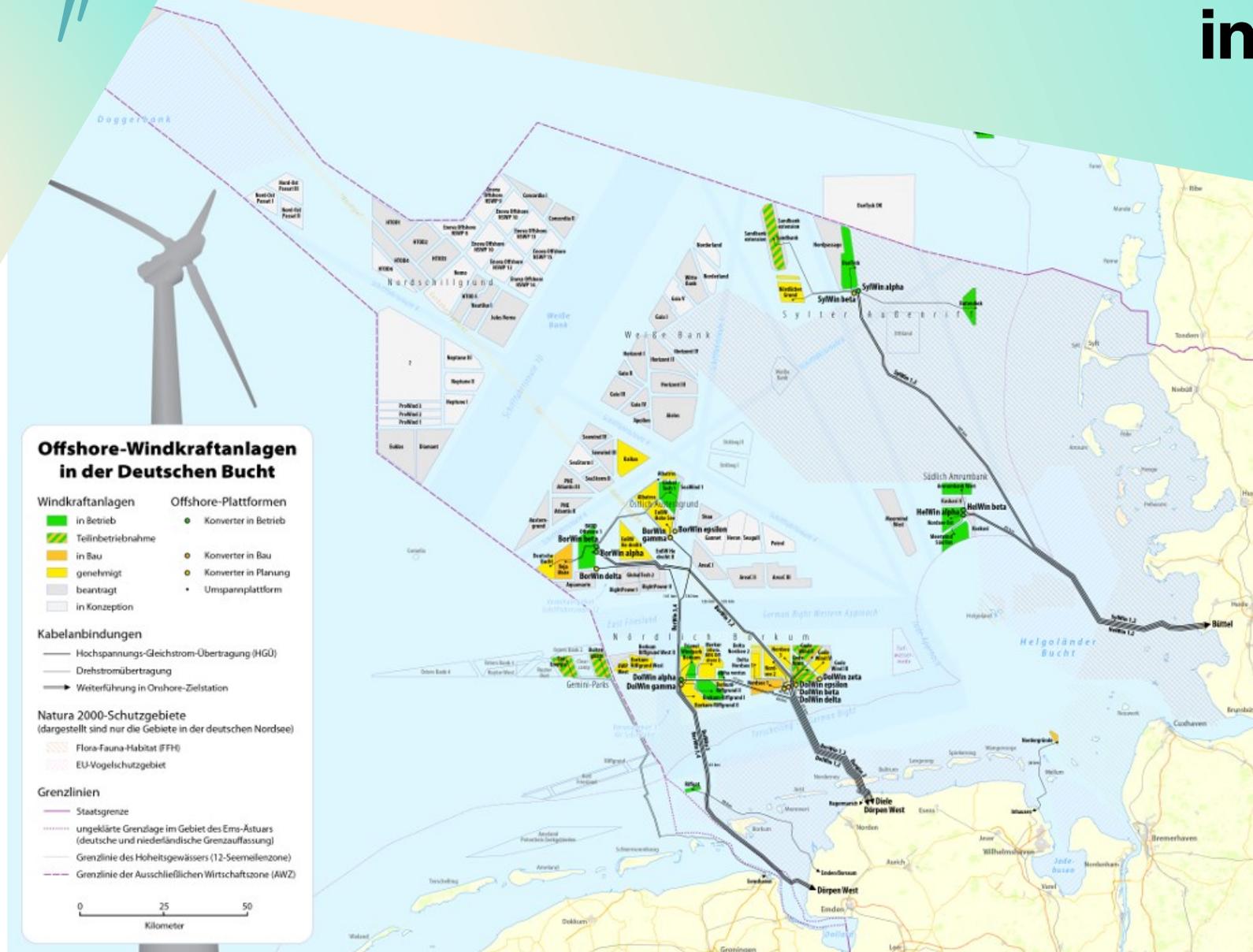
165 GW

Promised by Governments
by 2030



Erwartung für das Jahr 2050:

- ▶ **285 Offshore Windparks**
- ▶ **400 Gigawatt Leistung**



https://de.wikipedia.org/wiki/Offshore-Windpark_Deutsche_Bucht#/media/Datei:Karte_Offshore-Windkraftanlagen_in_der_Deutschen_Bucht.png

... ein paar Kennzahlen ...

ENERGETISCHE AMORTISATIONSDAUER:

- ▶ Onshore: ca. 3-6 Monate
- ▶ Offshore: ca. 5-9 Monate

ERNTEFAKTOREN:

- ▶ Ca. 40-50

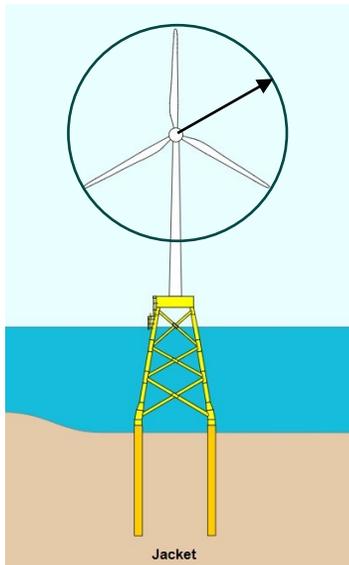
INVESTITIONSKOSTEN OFFSHORE-WINDPARKS:

- ▶ Ca 1,55 Mrd Euro für 1400 MW (Bsp. East Anglia THREE)

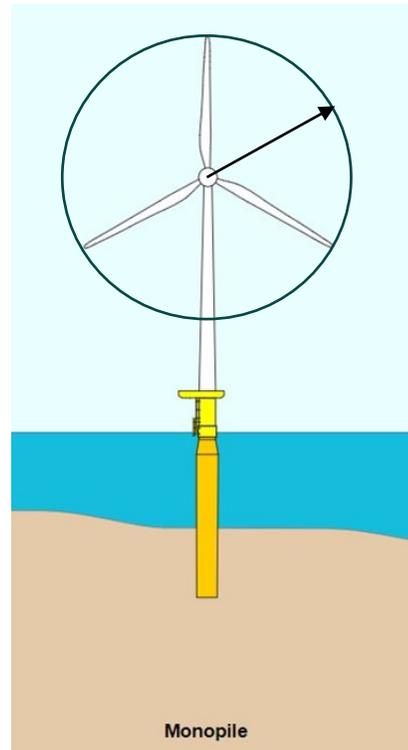
ENERGIEERZEUGUNGSKOSTEN:

- ▶ Onshore: ab ca. 4 Cent/kWh
- ▶ Offshore bottom fixed: ab ca. 7 Cent/kWh
- ▶ Offshore floating: ab ca. 12 Cent/kWh

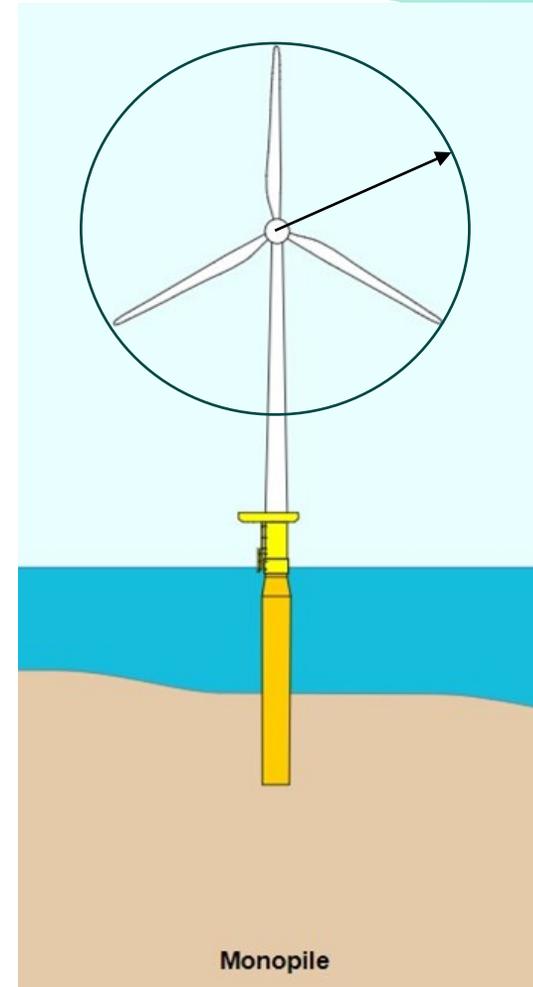
East Anglia 1 (2018)
7 MW Turbinen
154m Rotordurchmesser



East Anglia 3 (2023)
14+ MW Turbinen
236m Rotordurchmesser



East Anglia 1N (2026 ?)
21+ MW Turbinen
320m Rotordurchmesser



Monopilefundierung

bis 100-140 Meter lange Stahlpfähle
120-150 mm Wandstärke
1800-3500 Tonnen pro Stück



Offshore Windfarm EA3

Condition Monitoring System
für eine Windfarm mit 100 Stück 14+ MW Turbinen

East Anglia THREE

Could power the equivalent of over

1.3 million

homes



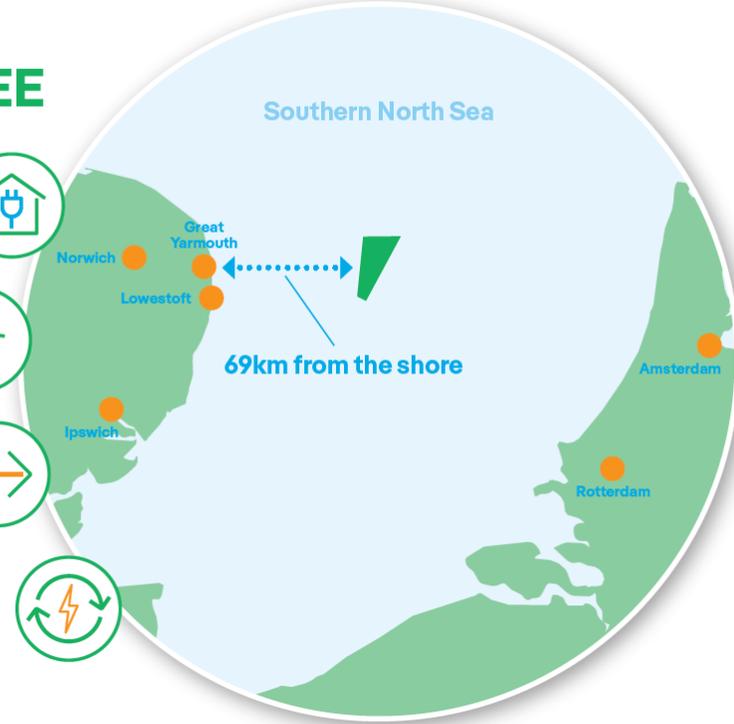
Up to
100
wind turbines



305km²
windfarm area

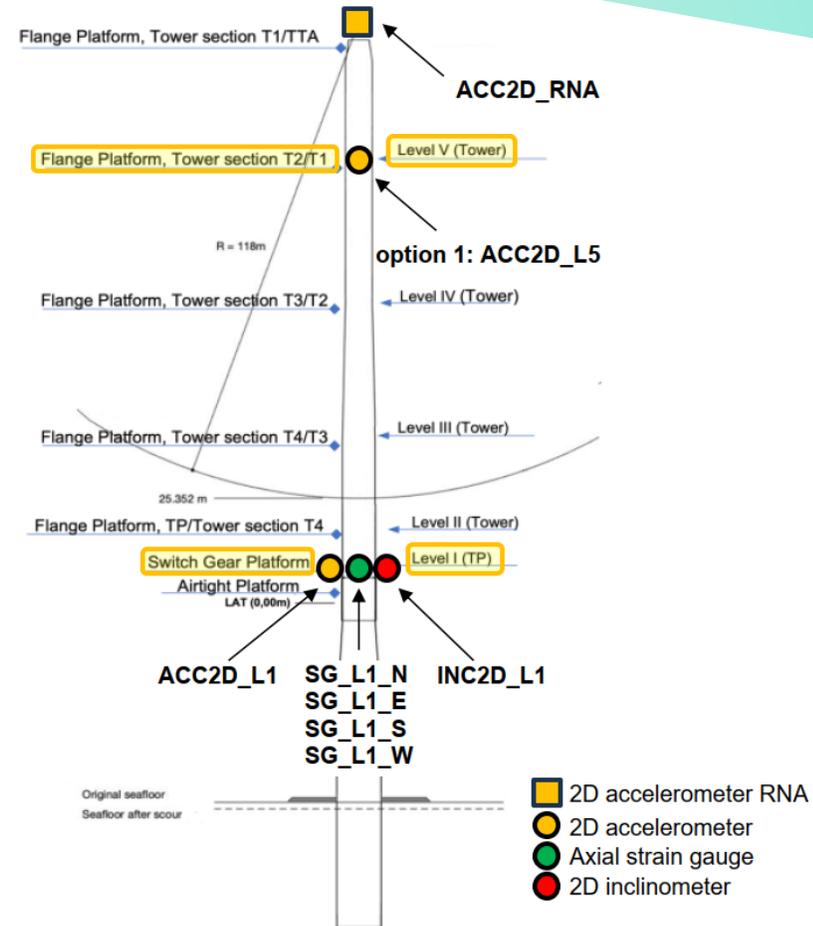
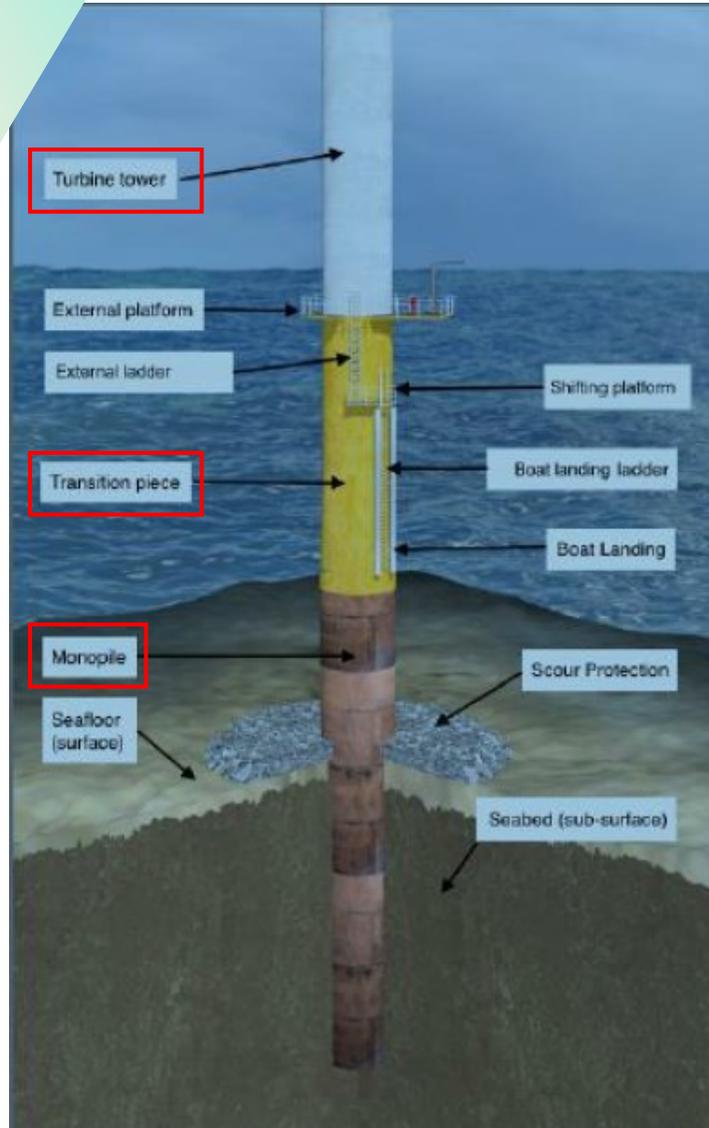


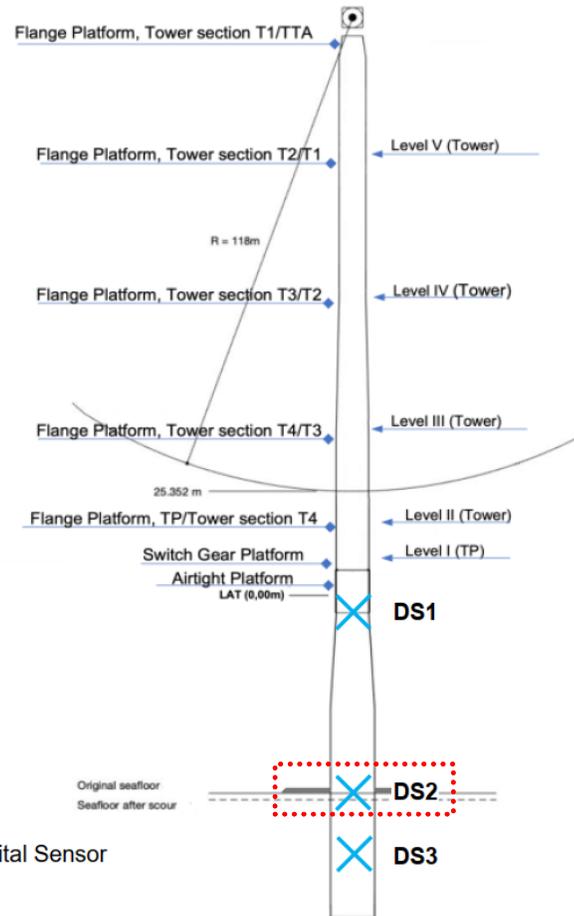
Up to
1,400
Megawatts



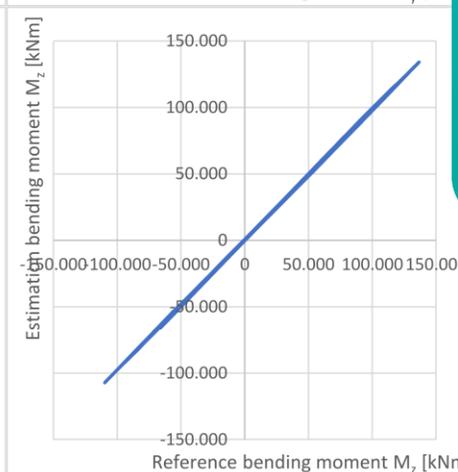
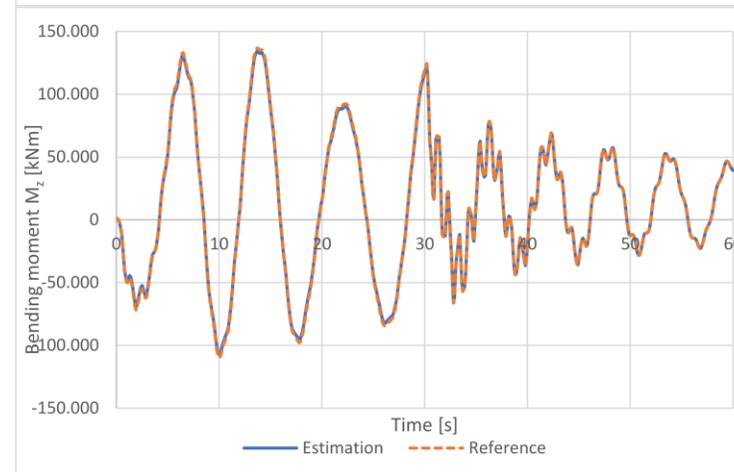
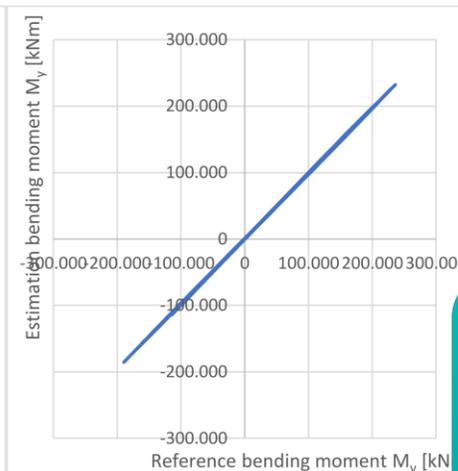
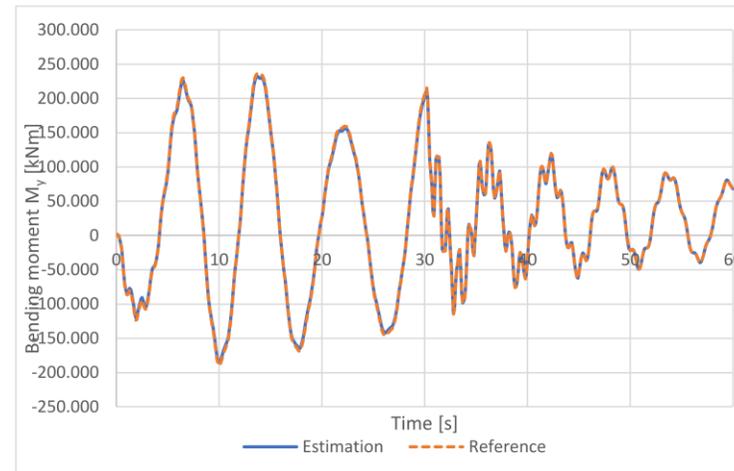
**6 WTG mit
CMS**

East Anglia 3 Sensorlayout





X Digital Sensor



**Beschleunigungs-
sensoren**
**Spannungs-
ermittlung**
**Ermüdungs-
abschätzung**

East Anglia 1

Total 102 Stück 7 MW Turbinen
Condition Monitoring System für 65 WTGs



East Anglia ONE

Powering the equivalent of around

700,000

homes each year



102

wind turbines



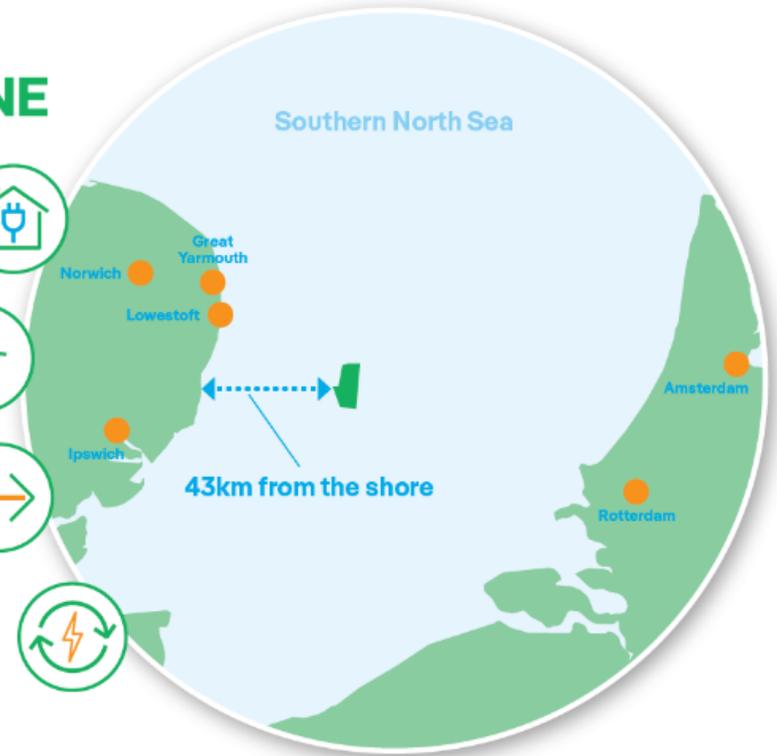
300km²

windfarm area



714

Megawatts

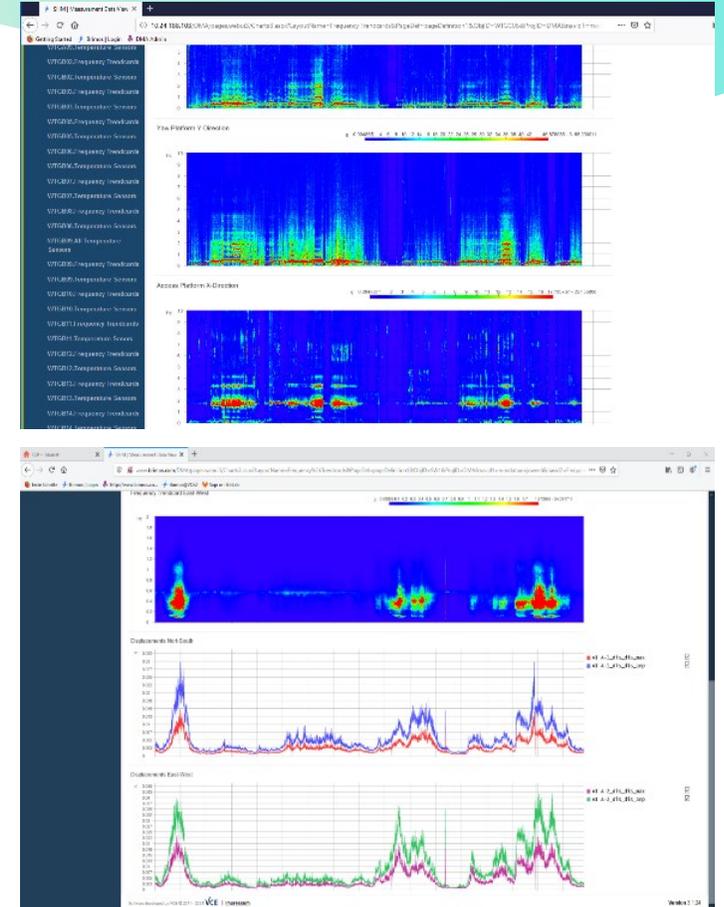


SHM für 13 Offshore-Konverterstationen



TenneT Konverter Stationen

Systemidentifikation Monitoren von Systemeigenschaften



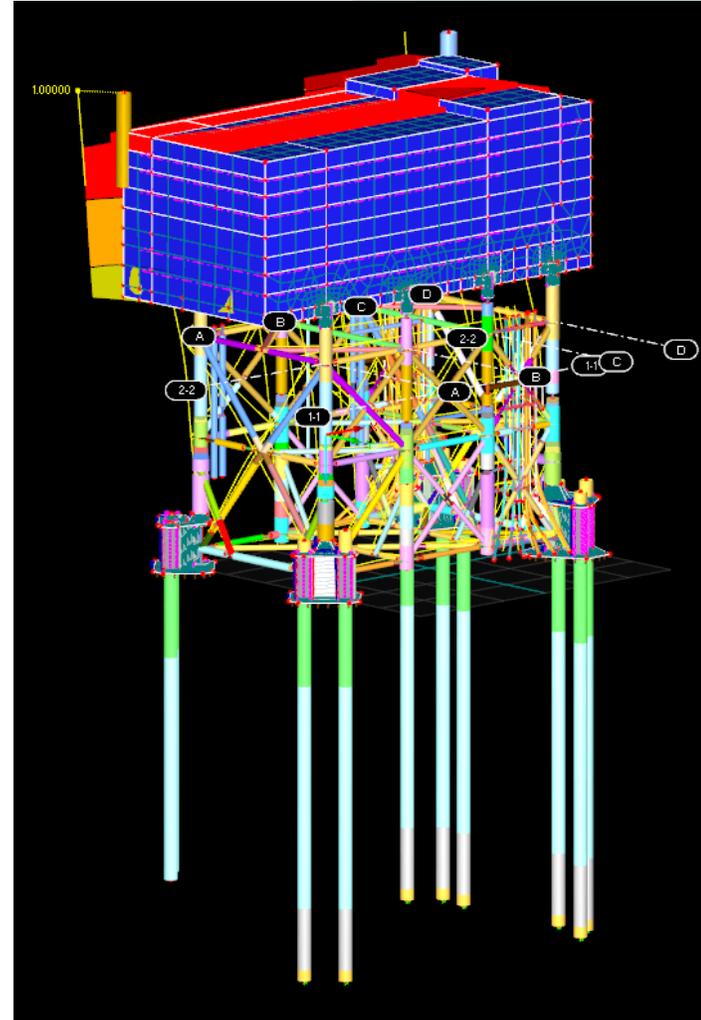
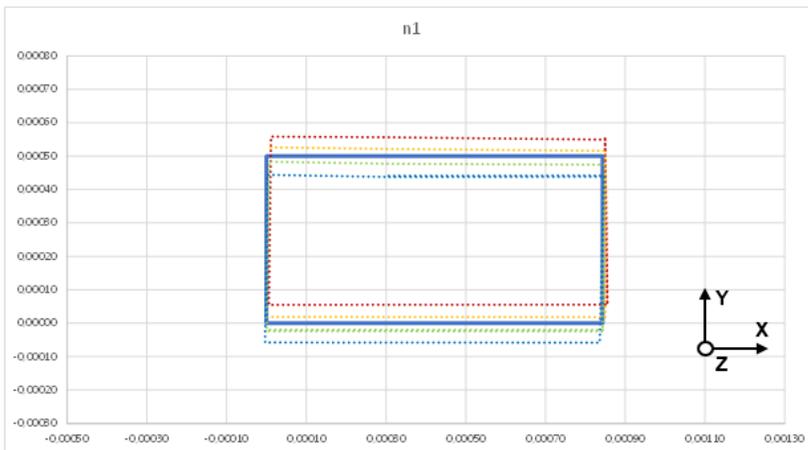
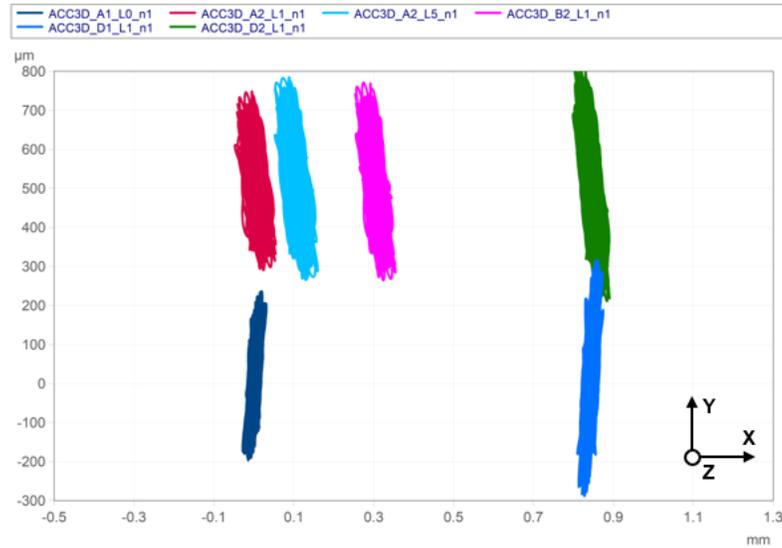
TenneT Konverter Stationen

Erstellen & kalibrieren FEM-Modell

Sensitivitätsanalysen

Ermüdungsberechnungen

Restlebensdauerprognose



Hochvolt-Gleichstrom-Leitungen

Baubegleitender
Immissionsschutz



Floating Wind Mittelmeer

5 Prototypen mit je 14+ MW schwimmend

